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## Taxonomic and Biological Notes on the *Hemileuca maia* Complex (Saturniidae) with Description of a New Species from Texas and New Mexico

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**Abstract** A brief taxonomic and biological review of the monophyletic *Hemileuca maia* complex is presented. *Hemileuca peigleri* LEMAIRE, **n. stat.**, from central Texas is elevated to full species rank, a new species, *H. slosseri*, from New Mexico and Texas is described, and *H. artemis* PACKARD, **sp. rev.**, from New Mexico is resurrected from synonymy. Also presented is a discussion of hostplants, larval and adult moth diagnoses, reported diseases and insect parasitoids, and habitat conservation.

### Introduction

Throughout the continental United States there occur representatives of a complex of small to medium sized diurnal saturniid moths of the genus *Hemileuca* WALKER 1855. The genus is extensive, with several species groups (FERGUSON, 1971; TUSKES, 1984). This paper deals with the group in the genus containing oak and willow feeding species such as *H. maia* (DRURY, 1773), *H. nevadensis* STRETCH (1872), and *H. lucina* Henry EDWARDS (1887). The complex was considered to consist of the three aforementioned species by all earlier authors. In this paper we will provide evidence that at least three additional species exist (Fig. 1); the first is described below as new, the second is *H. artemis* PACKARD (1893) which is herein resurrected from the synonymy of *H. nevadensis*, and the third is *H. peigleri* LEMAIRE (1981) n. stat. which was originally described as a subspecies of *H. maia*. The isolated distributions and distinctive larval and adult morphology observed in all six of the taxa leave no doubt that six distinct species are involved.

The moths are univoltine, overwintering in egg masses on twigs of the host plant.

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Larvae bear urticating spines and feed during spring, pupating in late spring or summer. The dorsal scoli on the later larval instars offer cryptic advantage by resembling dead catkins on oak. The black and white adults fly during midday in the fall, as early as September in the North and as late as December in the Deep South. The sister-group of the complex consists of a smaller group of species in the Southwest, containing *H. grotei* GROTE & ROBINSON 1868, *H. diana* PACKARD 1874 (see KENDALL and PEIGLER, 1981; TUSKES, 1986) and possibly *H. electra* WRIGHT 1884 and *H. juno* PACKARD 1872.

Before reviewing the complex in general, we describe below a new species from northern Texas and southeastern New Mexico. This species became apparent to us through material collected by J. E. SLOSSER, J. K. WANGBERG, and R. O. and C. A. KENDALL. Roy and Connie KENDALL reared large numbers of this new species, making abundant material of adult and immature stages available for this study. Equally important, Tony SMITH provided material of *H. artemis* from New Mexico for comparison, thereby enabling us to confirm that the new species was not the same as *H. nevadensis* or *H. artemis*.

***Hemileuca slosseri* PEIGLER & STONE, n. sp.**

**Type Material**

**Holotype** ♂. TEXAS: Kent County, Jayton, reared *ex-ovo* on *Quercus fusiformis*, emerged 6 IX 1982, Roy. O. KENDALL & C. A. KENDALL. **Allotype** ♀. TEXAS: Kent County, Jayton, netted 6 XI 1980, J. E. SLOSSER. The holotype and allotype were deposited in the Los Angeles County Museum of Natural History, California.

**Paratypes.** 3♂ NEW MEXICO: Chaves County, Elkins, 10 X 1959, Noel MCFARLAND, "St. 10". 4♂ TEXAS: Yoakum County, Taylor Ranch near Tokio, 4 XI 1980, J. K. WANGBERG. 1♂ 2♀ TEXAS: Kent County, Jayton, 25 X 1980 and 5 XII 1980, Gary J. PUTERKA. 6♂ 1♀ Jayton, netted 6 XI 1980 by J. E. SLOSSER & Rex PRICE. 3♂ 1♀ Jayton, netted 6 XI 1981 by J. E. SLOSSER & Rex PRICE. 91♂ 80♀ Jayton, reared *ex-ovo* in 1982 in San Antonio, Texas on *Quercus fusiformis* by R. O. & C. A. KENDALL, emerged over three years as cited in Table 1.

The paratypes are in the following collections: Roy O. KENDALL and C. A. KENDALL (San Antonio); Texas A & M University (College Station); Texas Tech University (Lubbock); Texas A & M University Agricultural Research & Extension Center Chillicothe-Vernon (Vernon); Los Angeles County Museum of Natural History; Claude LEMAIRE; Michael J. SMITH; Stephen E. STONE; Wolfgang A. NÄSSIG; Richard S. PEIGLER; Benjamin D. WILLIAMS; and the National Science Museum, Tokyo.

**Adult.** In males, length of forewing 26–33 mm, average 30 mm; length of hindwing 19–25 mm, average 22 mm (N=19). In females, length of forewing 30–38 mm, average 34 mm; length of hindwing 20–28 mm, average 24 mm (N=12). Antennae and head black; body covered with black scales with two scarlet tufts on thorax, and scarlet distal abdominal segments in males; legs black with scarlet tufts

Table 1. Data for Paratypes of *Hemileuca slosseri*

DATE			♂	♀	DATE			♂	♀
20	VIII	1982	—	1	13	X	82	1	—
25	VIII	82	2	2	14	X	82	—	1
26	VIII	82	3	4	17	X	82	—	2
27	VIII	82	1	—	26	X	82	—	2
28	VIII	82	—	2	24	X	82	—	1
29	VIII	82	3	—	25	X	82	—	2
30	VIII	82	—	3	20	X	1983	1	—
31	VIII	82	9	3	21	X	83	1	—
1	IX	82	5	3	23	X	83	1	—
2	IX	82	4	1	26	X	83	1	—
3	IX	82	4	3	28	X	83	1	—
4	IX	82	1	2	29	X	83	1	1
5	IX	82	5	2	30	X	83	—	1
6	IX	82	7	3	31	X	83	2	1
7	IX	82	4	—	2	XI	83	1	—
8	IX	82	2	2	3	XI	83	—	1
9	IX	82	1	4	4	XI	83	1	—
10	IX	82	5	3	5	XI	83	—	2
11	IX	82	—	4	7	XI	83	1	1
12	IX	82	1	—	8	XI	83	—	1
13	IX	82	2	—	12	XI	83	1	1
14	IX	82	1	—	13	XI	83	1	—
15	IX	82	1	—	14	XI	83	—	1
16	IX	82	1	2	15	XI	83	1	—
17	IX	82	1	—	16	XI	83	1	—
21	IX	82	1	—	18	XI	83	1	—
3	X	82	—	1	19	XI	83	—	1
4	X	82	1	—	16	X	1984	1	—
6	X	82	—	1	21	X	84	—	1
7	X	82	—	2	24	X	84	—	1
8	X	82	1	—	27	X	84	—	1
9	X	82	1	2	29	X	84	1	—
10	X	82	1	3	31	X	84	1	—
11	X	82	1	—	8	XI	84	—	1
12	X	82	1	2	9	XI	84	—	1
					13	XI	84	1	1

on femora. Wings semi-transparent; bases, costal margin and distal edges gray or blackened; median area creamy white, broader toward costal margin in forewing and hindwing, 5–12 mm wide; in each wing a black spot with a white slit within. Underside same as upperside, with white median area same width as upperside.

**Adult Diagnosis.** *Hemileuca slosseri* differs from *H. artemis* by having more transparent, glossy wings and narrower white bands. The white bands are more expansive in *H. artemis* than in all other members of the complex. The wingshape of *H. artemis* is more rounded and less elongated than in *H. slosseri*. *Hemileuca slosseri* agrees with *H. peigleri* in wingshape and the transparent aspect, but the latter has much reduced white bands. *Hemileuca lucina* was probably named for this transparent

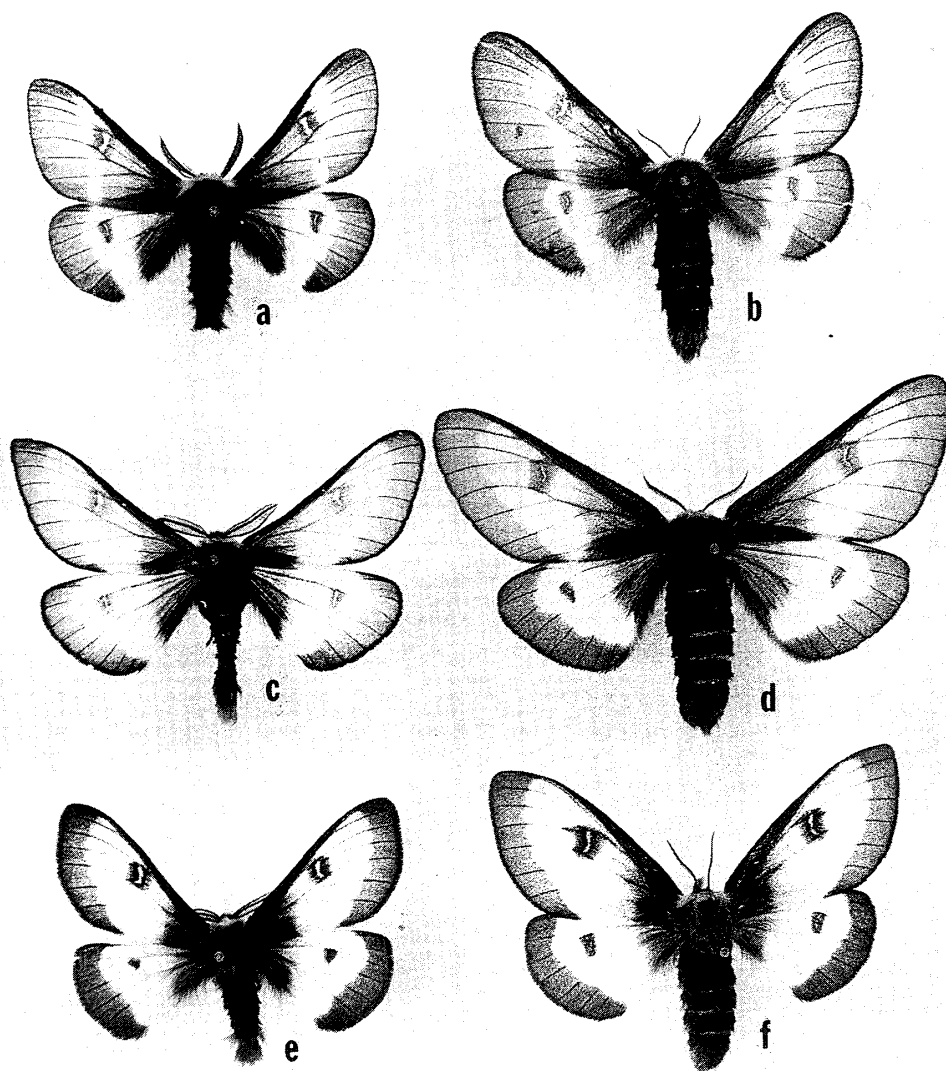


Fig. 1. **a.** *Hemileuca peigleri* ♂, Kimble Co., Texas, *ex-larva* on *Quercus fusiformis*, 12 X 1979, J. E. EGER. **b.** *H. peigleri* ♀, paratype, Mills Co., Texas, *ex-larva*, 2 XI 1978, R. S. PEIGLER. **c.** *H. slosseri* ♂, paratype, Jayton, Kent Co., Texas, 6 XI 1980, J. E. SLOSSER. **d.** *H. slosseri* ♀, paratype, Jayton, Texas, *ex-ovo*, 26 VIII 1982, R. O. & C. A. KENDALL. **e, f.** *H. artemis* ♂ ♀, White Sands, Otero Co., New Mexico, *ex-ovo* on *Populus fremontii* var. *wislizenii*, IX 1986, T. SMITH. (All specimens figured were deposited in the Los Angeles County Museum.)

quality shared by the two Texas species, which is basically absent in *H. maia*, *H. nevadensis*, and *H. artemis*. The diagnostic characters can be seen in Fig. 1.

**Genitalia. Male.** Uncus bilobed, strongly recurved, heavily sclerotized; medial process of transtilla elongated, sclerotized, slightly rolled and notched; valvae with small weak lobes; anellus rounded, sclerotized; saccus slightly elongated. **Female.** Oviporus elongated with two rounded lobes; genital plate sclerotized with median ring

heavily sclerotized; ring with four notches, two inner ones smaller; valvulae not visible; apophyses thin, short.

**Genitalic Diagnosis.** In males, the genitalia of *H. slosseri* are larger overall, especially at the apical end, when compared to all other species. The anellus is more sclerotized than in *H. artemis*. The saccus is more elongated than in *H. nevadensis*. We agree with the conclusions of FERGUSON (1971) and LEMAIRE (1981) that male genitalia in this complex do not show reliable characters. The differences among the six known species are only weakly evident.

In females, the oviporus is largest in *H. nevadensis*, but in this species the central sclerotized ring at the center of the genital plate is smallest. This sclerotized ring is widest in *H. artemis*, smallest in *H. slosseri* and *H. peigleri*. The left and right components of the ring are disjunct in *H. peigleri* and *H. artemis*, but attached in *H. slosseri* and *H. nevadensis*.

Following is a description of a mature *Hemileuca slosseri* larva based on living material (N=50) collected on *Q. havardii* RYDB. in Kent County, Texas.

**Description of mature *Hemileuca slosseri* larva.** Head blackish maroon, covered with white setae; width 5–6 mm. Integument pale yellow, with little or no mottling visible rarely with moderate mottling; mottling sometimes visible, without magnification as tiny brown or black patches on segmental lines, and under magnification as numerous brown flecks; thoracic legs solidly brownish black; lower portion of all abdominal prolegs maroon; dorsal prothoracic plate and anal plate both reddish brown; dorsal scoli black rosettes of ca. 35 blunt spines with one longer central one; subdorsal scoli ca. 3 mm long, subspiracular scoli ca. 2 mm long, both rows black, branched, with white tips; subventral scoli on segments 1–5, 10, and 12 smaller but branched and colored as in others; a pair of widely separated setae with brown bases on dorsum behind and below dorsal rosette scoli. Length 55–65 mm.

**Larval diagnosis** (see Fig. 2). The mature larva of *H. slosseri* superficially most resembles that of *H. artemis* due to the light coloration and reduction of mottling and scoli. In *H. slosseri* the integument is light yellow with mottling absent or extremely reduced; in *H. artemis* it is creamy white with black mottling reduced in size but abundant in number and easily visible. In *H. slosseri* the dorsal rosette scoli are small black tufts of ca. 35 blunt spines, with a longer slender spine emerging from the center; in *H. artemis* the dorsal rosette scoli are smaller tufts of ca. 15 blunt white spines that are brownish proximally and black distally, with a longer black spine in the center bearing the slender spine. In *H. slosseri* the other scoli are generally larger and almost entirely black; those in *H. artemis* have conspicuous white branches on the black stalks. In *H. maia* (Baton Rouge, Louisiana), *H. nevadensis* (Escondido, California; Cedar City, Utah; Lyon Co., Nevada; and Littleton, Colorado) and *H. peigleri* (Bexar Co., Texas) the larvae are strongly mottled on the integument and bear larger and longer scoli. The half grown larvae of *H. slosseri* are all solidly yellowish as are mature larvae; those of *H. artemis* are much covered by black mottling when half grown.

**Distribution.** *Hemileuca slosseri* is known from the following localities (those not

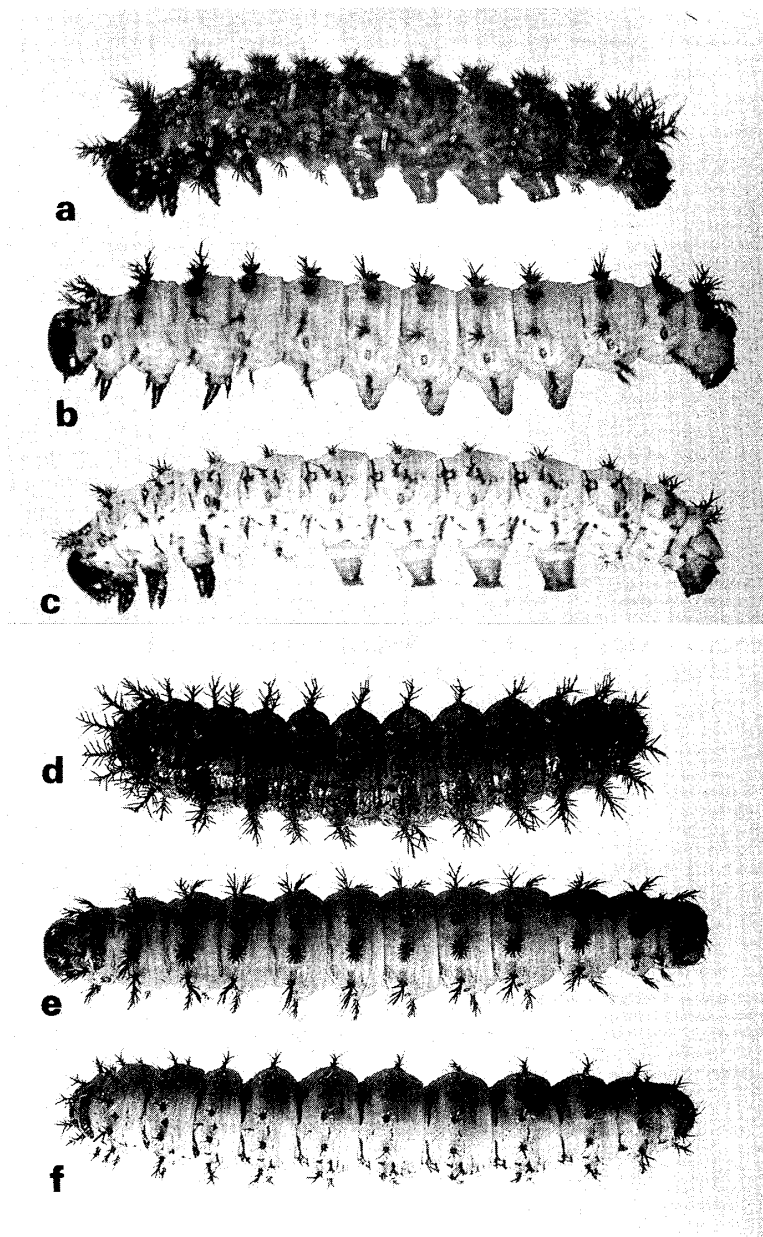


Fig. 2. Mature larvae of *Hemileuca*. a, d. *H. nevadensis*, Escondido, California. b, e. *H. slosseri*, Jayton, Texas. c, f. *H. artemis*, White Sands, New Mexico. a-c. Lateral views. d-f. Dorsal views.

represented by paratypes are represented by larvae in alcohol in the KENDALL collection): TEXAS: Jayton, Kent County; ca. 17 km west of Paducah, Cottle County (J. E. SLOSSER, pers. comm.); 8 km north of Dickens, Dickens County; 5 km west of Swenson, Stonewall County; 10.5 km southwest of Wellman, Terry County; W. M. Taylor Ranch, ca. 13 km northeast of Tokio, Yoakum County; Andrews, Andrews County (Mark MOSELY, collector); NEW MEXICO: Elkins, Chaves County. An additional Texas locality cited by WANGBERG (1983) of 40 km west of Seminole is in Gaines County, not Andrews County (J. K. WANGBERG, pers. comm. to R. O. KENDALL).

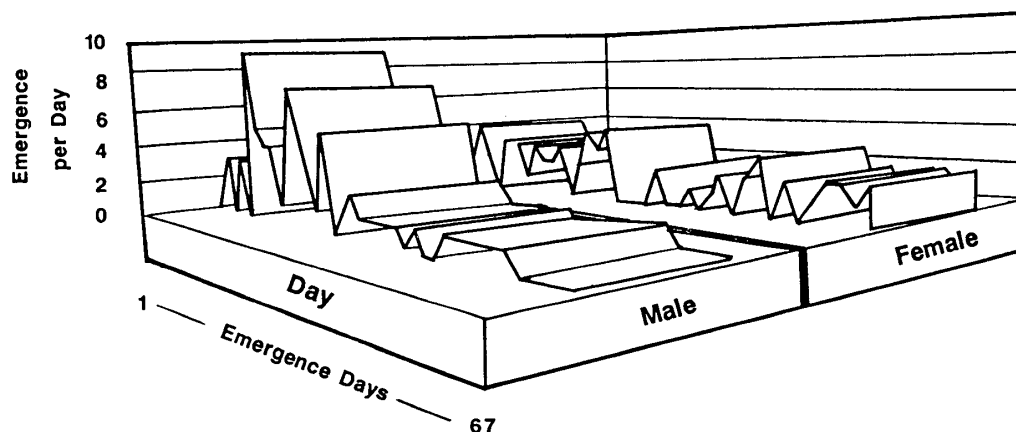
**Hemileuca slosseri****Emergence 1982**

Fig. 3. Graph showing emergence pattern of *H. slosseri* showing differential in gender.

This latter site is very near Hobbs, New Mexico.

**Field Observations.** Data supplied by J. E. SLOSSER and R. O. KENDALL form the basis of this section. The majority of egg rings contain few eggs, although some are larger (KENDALL), with 10–71 eggs per mass (WANGBERG, 1983). These were only found on low shinnery oaks less than 0.5 m above ground level, although SLOSSER and KENDALL searched on oaks more than 2 m high. Eclosion is in mid-April, coinciding with opening of leaf buds. Larvae pupate in late May or early June. The pupal stage in captivity may last two or more years; adults emerged from a single lot of pupae over three consecutive autumns (Table 1) (Roy KENDALL, pers. comm.). This extended pupal duration is normal for the genus (PEIGLER, 1985b). In nature, adults start emerging about early November, approximately coinciding with the first frost. Although probably not statistically significant, the specimens reared by the KENDALLS had an interesting emergence pattern in 1982 (Fig. 3). Throughout the 67 day emergence period females hatched at a fairly consistent rate. Conversely, male emergence peaked predominantly during the early part of the emergence period. The reasons for this differential gender emergence are presently unclear. For comparison, see emergence pattern data given by PEIGLER and WILLIAMS (1984). Mating occurs about 0.5 m above ground on stems of the hostplant. Circadian activity of adults flying during midday hours is typical of the genus. Additional information pertaining to hostplants, habitat, diseases, and parasitoids is presented in other sections below.

**Etymology.** Dr. Jeffrey E. SLOSSER of the Texas Agricultural Experiment Station in Vernon, Texas has contributed in many ways to the knowledge of this species. We take great pleasure, following the suggestion of Roy KENDALL, in naming this moth in his honor.

### Taxonomy and Distribution of the Complex

*Hemileuca maia* ranges throughout eastern North America. Most populations are associated with scrub oaks (*Quercus ilicifolia* WANGENH. in the North and *Q. laevis* WALT. in the South) which grow in sandy areas under pines (*Pinus* : Pinaceae). These biomes are subject to natural periodic fires which help maintain the balance of tall pines and low oaks (CRYAN and DIRIG, 1977; COOPER, 1961). In the Carolinas and Georgia the biome is called uplands or sandhills. This biome extends through the middle of those states corresponding to the ancient coastline. In the southwestern portion of its range, *H. maia* is associated with live oak (*Q. virginiana* MILL.) in localities such as Baton Rouge (LEMAIRE, 1981; MITCHELL et al., 1985) and New Orleans, but the species is not restricted to urban environments in that region. In the northwestern portion of its range, certain populations are associated with willow (*Salix* : Salicaceae) rather than oak in places like northern Illinois (FERGUSON, 1971) and Lucas Co., Ohio (T. W. CARR, pers. comm.). However, some populations in Lucas Co. are also apparently associated with oak (METZLER, 1980). To the west, the KENDALLS have collected *H. maia* in Logan Co., Oklahoma. The type-locality of *H. maia* is New York.

*Hemileuca nevadensis* apparently ranges widely in western North America from British Columbia to the Dakotas, south to the Mexican border, although we have determined in the present study that almost no material from Texas or New Mexico belongs under this taxon, one exception being a specimen from Maxwell, Colfax Co., New Mexico figured by FERGUSON (1971, pl. 8, fig. 16). That locality is near the Colorado border, and *H. nevadensis* is well known to us from central Colorado. The larvae feed on various species of willow and cottonwoods (*Populus* : Salicaceae). Its habitat is riparian, within Great Basin desertscrub and plains grassland in the Southwest (BROWN and LOWE, 1982), and other biomes northward (TUSKES, 1984). Despite intense collecting in southeastern Arizona, this species has not been found there (M. J. SMITH, pers. comm.). The type-locality of *H. nevadensis* is Dayton, Lyon Co., in western Nevada near Virginia City.

*Hemileuca lucina* ranges from Michigan to Maine, feeding in wet areas on meadowsweet (*Spiraea latifolia* BORKH., Rosaceae). It has been hybridized with *H. nevadensis*, the sterile females leaving no doubt that two separate species are involved (PEIGLER and WILLIAMS, 1984). The type-locality is Norway, Oxford Co., Maine, as restricted by lectotype designation (FERGUSON 1971 : 123).

*Hemileuca peigleri* is an endemic of the Edwards Plateau of central Texas (Fig. 4). Its range corresponds to that of *H. grotei* except that the latter continues into the panhandle of Texas (sympatric with *H. slosseri*), whereas *H. peigleri* is not known to range north of Brown County. A broad zone at least 100 km wide running from Fort Worth westward to Odessa separates the distributions of *H. peigleri* and *H. slosseri*. *Quercus macrocarpa* MICHX., *Q. marilandica* MUENCH., *Q. fusiformis* SMALL, *Q. durandii* BUCKL., and other oaks have ranges which terminate along the same northwestern edge as that of *H. peigleri* (MILLER and LAMB, 1985). Larvae of *H. peigleri* feed on *Q.*



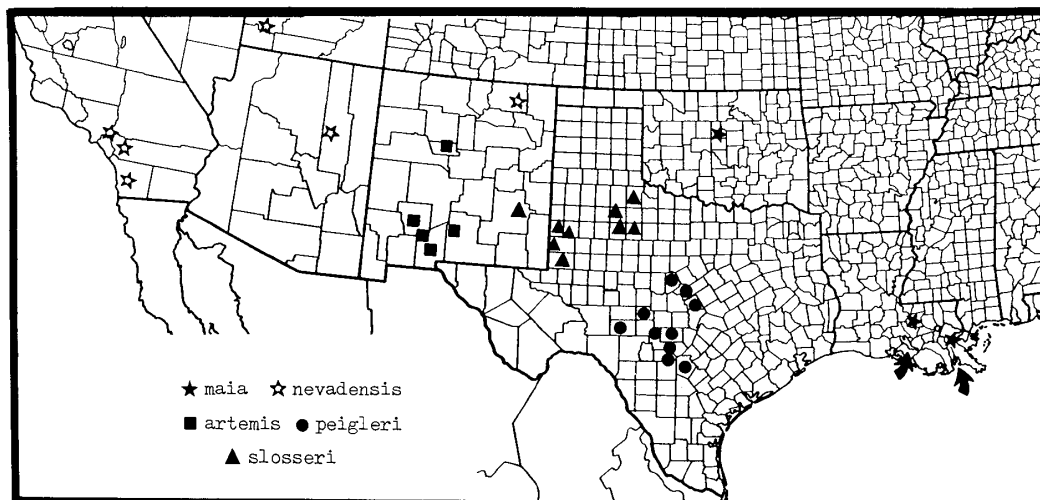


Fig. 4. Map of southwestern United States showing all known localities for *H. slosseri*, *H. artemis*, and *H. peigleri*, with nearest known localities of *H. maia* and *H. nevadensis*.

*fusiformis*, *Q. texana* BUCKL., and other oaks. To the east of the Edwards Plateau there is a region stretching from Williamson Co., Texas to Baton Rouge, Louisiana (encompassing the eastern third of Texas and western half of Louisiana) where no species of the genus occurs. The senior author lived and collected extensively in this region for several years and no *Hemileuca* were observed. The ranges of *H. maia* and *H. peigleri* are clearly separated by several hundred km of unsuitable biotope consisting of eastern deciduous forest mixed with pine, and post oak savannah. The type-locality of *H. peigleri* is San Antonio, Bexar Co., Texas. FERGUSON (1971) stated that *H. maia* and *H. nevadensis* "may also meet in central Texas, as material examined from Fredericksburg appeared to include both." We are aware of no valid records of neither *H. maia* nor *H. nevadensis* occurring anywhere within the border of Texas, although we agree with the identification of all specimens in this complex figured in color by FERGUSON (1971, pl. 8).

Although we have provided geographical and morphological data for the elevation of *H. peigleri* to species level earlier in this paper, the original author (LEMAIRE, 1981 : Table 1), speculated that *H. peigleri* could be a full species, and in fact, developed a table listing the larval differences between *H. maia* and *H. peigleri*. Furthermore, STONE et al. (1989) discussed the definition of subspecies as it applies to the genus *Hemileuca*, and *H. maia* and *H. peigleri* clearly are not within that definition.

*Hemileuca artemis* PACKARD (1893) has been synonymized under *H. nevadensis* by virtually all workers since the original description (BOUVIER, 1932 ; COMSTOCK and DAMMERS, 1939 ; FERGUSON, 1971). This is probably because the adults are similar, larvae of both species are associated with Salicaceae, and larvae of *H. nevadensis* are known to be geographically variable. However, we strongly contend that the larva of *H. artemis* does not fall within the variation of *H. nevadensis*. Colored figures of the larval stages and adult were given by PACKARD (1914, pl. 23). A comparison of the aforementioned description to that of *H. nevadensis* provided by COMSTOCK and

DAMMERS (1939) and TUSKES (1984) unmistakably indicates that the two taxa are not conspecific. *Hemileuca artemis* is known to occur in central New Mexico along the Rio Grande from Albuquerque south almost to El Paso. The known localities are Alameda, Bernalillo Co.; Las Palomas, Sierra Co.; Rincon, Mesilla, and Las Cruces (type-locality), all in Doña Ana Co. (PACKARD, 1914); and White Sands National Monument (NM), Otero Co., less than 100 km east of Rincon (FURNISS and CAROLIN, 1977 [as *H. nevadensis*]). The Sacramento and Guadalupe mountain ranges seem to form an effective barrier to the east, separating it from known localities of *H. slosseri*. Additional field collecting is needed to determine if the species ranges along the same river system north into Colorado or south into Texas and Chihuahua. Although ova and larvae of *H. artemis* have been taken on *Salix longifolia* MUHL. in the Las Cruces area (PACKARD, 1914), the primary host is the Rio Grande Valley cottonwood (*Populus fremontii* var. *wislizenii* [WATS.] SARGENT) (see PACKARD, 1914: 122, footnote).

The Rio Grande Valley cottonwood occurs along the Rio Grande from Mexico north through New Mexico to southern Colorado and in the San Juan Basin in northwestern New Mexico and southwestern Colorado (LAMB, 1977; LITTLE, 1979; VINES, 1976). The tree is also found in southern Utah and western Texas (SCHREINER, 1974; ELMORE, 1976). Throughout its range, the tree is principally a member of the riparian community and is usually found along river valleys and streambanks at elevations between 1,060 and 2,730 m (MARTIN and HUTCHINS, 1980; RYDBERG, 1906). *Hemileuca artemis* inhabits riparian areas in biomes such as Chihuahuan desertscrub, plains grassland, and semiarid grassland (BROWN and LOWE, 1982) and its known range is well within that of its primary hostplant.

PACKARD used the name *Artemis*, either in keeping with the tradition of naming Saturniidae after mythological figures (e. g. *Maia*), or because he believed that sagebrush (*Artemisia*: Compositae) was one of the hostplants. TOWNSEND (1893) reported *Hemileuca* larvae on sand sagebrush (*A. filifolia* TORR.) from northeastern Arizona (Navajo Springs, Apache County) which he misidentified as *H. maia*; those larvae were *Hemileuca magnifica* (ROTGER). The identity of this population as *H. magnifica* was confirmed in 1987 by M. SMITH, P. SAVAGE, and K. HANSEN. In the spring of that year, larvae identified as *H. magnifica* were collected on *A. filifolia* and in August HANSEN collected an adult male from this locality. TOWNSEND (1893) also reported finding *Hemileuca* larvae on *Salix* sp. near Winslow, Arizona. We examined a series of adults collected by David L. BAUER during 1946 on *Salix* sp. along the Little Colorado River, Winslow, Navajo Co., Arizona, sent to us on loan from the Los Angeles County Museum of Natural History. It was not possible to determine this series of old, faded adults with certainty, nor was examination of the female genitalia conclusive. This prompted a collecting trip on 23 V 1987 by the junior author and M. J. SMITH and P. J. SAVAGE. They collected larvae of instars 1–3 on *Salix lasiandra* BENTH. at Jacks Canyon near Winslow. Resulting mature larvae and fresh adults confirmed this population to be one of *H. nevadensis*. We know of no other locality records for this species in Arizona.

*Hemileuca slosseri* has a known range within that of its primary hostplant, shin-

nery oak (*Q. havardii*), as shown on maps in MILLER and LAMB (1985, fig. 70c), LITTLE (1979, map 138), and SLOSSER et al. (1985). Biomes occupied by *H. slosseri* in New Mexico are Great Plains desertscrub and plains grassland, and in Texas the rolling plains, but only where shinnery oak grows in all these. Specimens loaned to us from the Los Angeles County Museum of Natural History from Elkins, Chaves Co., New Mexico, also originated within the western edge of the range of this oak. Suitable habitat also occurs in southwestern Oklahoma and the eastern portion of the Texas panhandle, based on published maps of shinnery oak distribution. This biome east of the Pecos River differs markedly from the desert to the west of that river, where two species belonging to a different group of the genus *Hemileuca* occur (PEIGLER, 1985b). We believe that no species of the *H. maia* complex occurs in this section of far western Texas south of New Mexico except possibly *H. artemis* along the Rio Grande. The earliest reference to *H. slosseri* in the literature of which we are aware was in an article by JOHNSON (1982) about the work of R. O. KENDALL. Good observations on the biology of this insect were presented by WANGBERG (1983) who reported that the larvae cause severe defoliation.

### Hostplant Data

In the previous section we outlined available data pertaining to hostplant utilization in conjunction with distributions and taxonomy of the six species of this complex. Hostplant data as a taxonomic tool in this complex is risky because of reports cited above of *H. maia* accepting willow in nature. SMITH (1974) also reported that *H. maia* (stock from Albany Co., New York) accepted willow in captivity, but the larvae had been fed oak during the first two instars. However, LEEUW (1974) reported that *H. maia* larvae from the same source as used by SMITH were reared to maturity exclusively on weeping willow (*Salix babylonica* L.) and the adults were exceptionally large.

Larvae of *H. slosseri* reared by R. O. and C. A. KENDALL in San Antonio refused willow. Larvae of *H. maia* from Lucas Co., Ohio reared by the KENDALLS and the senior author refused oak. Larvae of *H. lucina* may feed on willow and oak in addition to the normal rosaceous host (W. D. WINTER, pers. comm.).

Reports of *H. maia* accepting hosts unrelated to oak or willow we do not consider significant since larvae of this genus are prone to wander across the ground in the last instar, resting and feeding on various other plants. FERGUSON (1971), CRYAN and DIRIG (1977), and TUSKES (1984) arrived at the same conclusion. Reports of a species in the *H. maia* complex feeding on mesquite (*Prosopis*: Leguminosae) (TOWNSEND, 1893; PACKARD, 1914) were misidentifications of *H. junio*.

Despite all the reported cases of diverse host plant selection, we can state the following conclusions: in all known cases, *H. nevadensis* and *H. artemis* utilize only Salicaceae, and *H. peigleri* and *H. slosseri* always feed on *Quercus*. The unresolved problems all belong under *H. maia* and *H. lucina* in the northern states. The recent paper by STAMP and BOWERS (1986) does not address these problems. Additionally, almost all oaks fed upon by these insects belong to the subgenus *Erythrobalanus*, called

black oaks (MARTIN and HUTCHINS, 1980 : 515) or red oaks (MILLER and LAMB, 1985 : 47).

### Diseases and Parasitoids

Larvae of *Hemileuca* from arid or semi-arid regions of the western half of North America succumb in high numbers to disease when reared in more humid conditions. This problem is less severe with *H. maia* from humid areas, although MITCHELL et al. (1985) reported a nuclear polyhedrosis virus (NPV) from the Baton Rouge population, and cited other reports in earlier literature. The senior author has observed NPV in *H. peigleri* and *H. grotei* (KENDALL and PEIGLER, 1981). WANGBERG (1983) reported that ca. 10 percent of *H. slosseri* larvae were killed by NPV during the last instar. We believe that viral diseases are a major control of population levels, especially during years when those levels rise markedly or when the season is unusually rainy. Rearing under lamps and/or providing sunlight daily to larvae in captivity (SMITH, 1974) and uncrowded rearing conditions greatly reduce loss to disease (STONE et al., 1989).

Parasitoids attacking the *H. maia* complex were cited by ARNAUD (1978) and KROMBEIN et al. (1979). Among the Tachinidae (Diptera) it is reported that *Belvosia bifasciata* (FABRICIUS) attacks *H. maia* in Baton Rouge (PEIGLER, 1985a), *H. peigleri* (LEMAIRE, 1981) and *H. slosseri* (WANGBERG, 1983), both in Texas, *H. lucina* in New England and other species of *Hemileuca* in California (ARNAUD, 1978). Gary J. PUTERKA and J. E. SLOSSER reared the following tachinids from *H. slosseri*, and kindly provided us with the records: *Belvosia bifasciata*, *Leschenaultia* sp. near *fulvipes* (BIGOT), *Chetogena* sp., *Exorista* sp., and possibly another species of *Leschenaultia*.

Within the Braconidae (Hymenoptera), *Cotesia electrae* (VIERECK) (formerly in *Apanteles*) is found to parasitize numerous species of Hemileucinae and Saturniinae in western North America (KROMBEIN et al., 1979), regardless of the hostplant of the host. ASKEW (1971) stated that species of the genus *Apanteles* are endoparasites, often gregarious, of unconcealed lepidopterous larvae. In addition to the host records of *C. electrae* cited by KROMBEIN et al. (1979) and PEIGLER (1985b), we can add the following : in *H. nevadensis* on *Salix*, Pawnee Buttes, Weld Co., Colorado, emerged 2–10 July 1985 ; in *Coloradia doris* BARNES on *Pinus ponderosa* LAWS., Horsetooth Ridge west of Fort Collins and east of Horsetooth Reservoir, Larimer Co., Colorado, emerged 18 July 1985. Material from the two aforementioned records was given to us by David LEATHERMAN ; and the determinations were made by P. M. MARSH ; voucher material is now in the Los Angeles County Museum of Natural History. The report of this braconid on *H. artemis* ? in Terry Co., Texas by PEIGLER (1985a) must now be corrected to *H. slosseri*. What is apparently this braconid also attacks *H. artemis* at Las Cruces, New Mexico (PACKARD, 1914). PUTERKA and SLOSSER have also reared *Cotesia hemileucae* (RILEY) (see PEIGLER, 1985a) and the ichneumonid *Enicospilus texanus* (ASHMEAD) from *H. slosseri*. The *E. texanus* was identified by us using the key in GAULD (1988).

### Conservation

While reviewing the literature cited in this paper, we became increasingly aware of the distressing problem wherein habitat for these moths is being destroyed or altered at a rapid rate and some species within this complex are targets for broad spectrum insecticides. Where population levels of *H. maia* are high in urban areas like Baton Rouge and New Orleans, public outcry sometimes results in chemical controls because the larvae bear stinging spines. During the 1960's population levels of *H. artemis* were so high at White Sands National Monument that repeated chemical controls were applied (FURNISS and CAROLIN, 1977). Indeed, *H. artemis* may no longer be found at Las Cruces because of habitat reduction and the population was severely impacted as a nontarget species of agricultural insecticide use (T. SMITH, pers. comm.). Additionally, some of these species may be unintentional reservoirs for diseases and parasites imported by the U. S. Department of Agriculture and other agencies for biological control of insect pests, such as the gypsy moth (*Lymantria dispar* [L.] : Lymantriidae). FURNISS and CAROLIN (1977) stated that between 1905 and 1930 two egg parasites, seven larval parasites, and two beetle predators were introduced and established to help control the gypsy moth. GERARDI and GRIMM (1979) stated that by 1958 the United States had imported 458 parasites and predators for control of various insect pests. Without doubt some of these insect control agents are facultative feeders and impact a broad spectrum of lepidopterous families, including Saturniidae.

Our discussions above should have made clear to the reader that species in the *H. maia* complex are not only hostplant specific but also habitat specific. Although oaks and willows are almost ubiquitous in North America, the *Hemileuca* clearly require particular soil types, reduction of low herbaceous plants, and other unknown factors. The future of such stenotopic insects is tied to that of their biotope. CRYAN and DIRIG (1977) described problems associated with the preservation of scrub oak-pine communities in northeastern areas. They also pointed out that since moths of each population differ phenotypically (and therefore genetically) from one another, all are valid candidates for preservation.

AUFFENBERG and FRANZ (1982) concluded that "the conservation of longleaf pine-oak habitats is most important. . . its continued destruction, for whatever reason, throughout the southeastern United States is deplorable, and steps should be taken to ensure that representative areas throughout this region are preserved". They indicated that elimination of fire, repeated use of off-road vehicles, and 'improved' forestry practices favoring pines all contribute to habitat loss in addition to obvious factors such as 'development'. MILLER and LAMB (1985) also complained that fire control and forestry practices leading to pure stands of pine are reducing oaks in these biomes. Mast from turkey oak (*Q. laevis*) forms an important source of food for deer and wild turkey during winter. COOPER (1961) advocated the value of controlled burning to favor pines, and added "fires at regular three-year intervals thereafter keep down worthless scrub oaks."

The threat to *H. slosseri* is not directed to the insect itself but to the habitat. In

this case the hostplant, shinnery oak, is considered undesirable and measures are taken to destroy it. The leaves of the oak are toxic to cattle, the trees displace preferred forage for livestock, and the leaf litter provides overwintering habitat for boll weevils (*Anthonomus grandis* BOHEMAN; Coleoptera: Curculionidae) which infest nearby cotton fields the following summer (SLOSSER et al., 1985; WANGBERG, 1983). Herbicides, fire, and shredding are all vehicles used to reduce stands of the oak, although fire used alone is least effective, as might be expected since the oaks evolved in the face of natural periodic fires (COOPER, 1961). Much habitat of the oaks and moths in northern Texas has already been lost to agriculture (see KENDALL and PEIGLER, 1981).

Clearly there are numerous and varied conflicts between continued existence of these moths or their habitat and the social attitudes and demands of civilization. We hope that none of these species will become threatened or endangered before steps are taken to stem the tide, because by that time it may be too late.

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## 摘 要

### 北米のヤマムガ科 *Hemileuca maia* 群と 1 新種の記載 (Richard S. PEIGLER & Stephen E. STONE)

亜科 Hemileucinae は熱帯アメリカで多様に分化した小～中型のヤマムガで、旧大陸には分布していない。本亜科は *Hemileuca* のほか、*Automeris* など、21 属、400 種ほどが数えられ、幼虫の刺毛に刺されると大変痛いことでも知られているが、北米に分布するのは 4 属、30 種に満たない。ここに扱われている *maia* 群の成虫は昼飛性で、卵越冬、春に孵化した幼虫は初夏には蛹化し、秋に羽化する。この群は従来 3 種とされてきたが、成虫の形態のほか、幼生期の知見を加えて再検討し、少なくとも 3 種が追加されなければならないことが判明した。そのうちの 1 種は新種として記載されている。

*Hemileuca maia* は東部に広く分布し、砂質土壤に成育するマツ林に混交する灌木性 *Quercus* につくことが多いが、この植生は季節的な自然発火による山火事によって維持されている。しかし、分布域の北西部では、ヤナギ類につくものがあることが知られている。一方、*H. nevadensis* は西部に分布し、川辺のヤナギやポプラ類につき、砂漠や草原など、乾燥気候に適応している。また、*H. lucina* は東部のミシガンからメインの湿潤な地方でホザキシモツケを食べ、*nevadensis* と交雑するが、その雌の妊性はない。



*Quercus* を食べる *H. peigleri* は *maia* の亜種として記載されたが、テキサス中部に孤立して分布し、成虫、幼虫ともに明瞭に区別できるので独立種と判断される。また、*H. artemis* は、従来比較的変異の多い *nevadensis* と同種とされてきたが、明らかな別種で、ニューメキシコ中部のリオ・グランデ川沿いに生息する。ヤナギ類の記録もあるが、ポプラの一種 *P. fremontii* var. *wislizenii* をおもに食べる。なお、種名の *artemis* はギリシャ神話の女神の名に由来し、同時に、ヨモギ類の属名 *Artemisia* に掛けているのだが、これは誤同定によるもので、ヨモギを食べるのは *H. magnifica* (ROTGER) であった。

新種として記載した *H. slosseri* は、食樹である灌木性のカン類 *Quercus havardii* に完全に依存しており、テキサス北西部からニューメキシコ東部の狭い範囲に分布している。成虫の翅型や斑紋、幼虫の色彩などで、近縁種と明瞭に区別できるが、交尾器ではむずかしい。幼虫は初夏に蛹化するが、蛹はその年の秋に羽化するとは限らず、翌年またはその翌年にも羽化することがある (Table 1)。なお、この蛹期間の延長は *Hemileuca* では普通にみられる現象である。羽化は初霜の降りる頃から始まり約 2 か月におよぶ。その間、雌はだいたい均一に羽化するが、雄の羽化は発生初期に集中している (Fig. 3)。

マイマイガの農薬や天敵による防除、農地の開発、生息環境の人為的な改変、住宅地域では衛生害虫として防除の対象となるほど、*Hemileuca* を保護するために克服しなければならない障害はきわめて多いが、手遅れにならないうちに何らかの対策が講じられることを願って止まない。

(大和田 守)